

## COMMUNICATION APPARATUS

### CLAIMS

What is claimed is:

- 1 1. A communications apparatus comprising:  
2 a receiving unit operable to receive link status flags, the  
3 link status flags included in frames received over a data  
4 communication link in response to link status flags included in  
5 frames transmitted over the data communication link; and  
6 a link status determination unit operable to determine  
7 whether a condition of the data communication link is normal  
8 based on whether the link status flags are received within a  
9 predetermined time.
- 1 2. The communication apparatus according to claim 1,  
2 wherein the link status determination unit is further operable to  
3 determine that the condition of the data communication link is  
4 invalid when the link status flags are not received within the  
5 predetermined time.
- 1 3. The communication apparatus according to claim 2,  
2 further comprising a link control unit operable to close the data  
3 communication link when the data communication link is  
4 determined to be invalid.

1 4. The communication apparatus according to claim 3,  
2 wherein the link control unit is further operable to open the data  
3 communication link when the recovery of the data  
4 communication link is determined to be possible.

1 5. The communication apparatus according to claim 4,  
2 further comprising a negotiation unit operable negotiate validity  
3 or invalidity of the data communication link with a link status  
4 determination unit of another device connected to the data  
5 communication link.

1 6. The communication apparatus according to claim 5,  
2 wherein the negotiation unit is further operable to transmit  
3 information requesting validity or invalidity of the data  
4 communication link to the link status determination unit of the  
5 other device connected to the data communication link and to  
6 receive a response from the link status determination unit of the  
7 other device connected to the data communication link.

1 7. The communication apparatus according to claim 6,  
2 further comprising a setting unit operable to set the link status  
3 determination unit to a valid or invalid condition.

1 8. The communication apparatus according to claim 7,  
2 wherein the negotiation unit is further operable to transmit  
3 information indicating a valid condition of the link status  
4 determination unit to the other device connected to the data  
5 communication link and the setting unit is further operable to set  
6 the link status determination unit to an invalid condition when  
7 the negotiation unit receives response indicating invalidity of the  
8 link status determination unit of the other device connected to  
9 the data communication link.

1 9. The communication apparatus according to claim 7,  
2 further comprising a link monitoring unit which is operable when  
3 the link status determination unit is set to an invalid condition  
4 and is operable to transmit an inspection frame to inspect a  
5 condition of the data communication link to the other device  
6 connected to the data communication line and to determine that a  
7 condition of the data communication link is normal upon  
8 receiving a response frame for the inspection frame from the  
9 other device connected to the data communication line within the  
10 predetermined time.

1 10. The communication apparatus according to claim 4,  
2 further comprising:  
3 a transmitter operable to transmit transmission object data  
4 received from a data transmission source over the data

5 communication link; and  
6 a data transmission control unit operable to suspend data  
7 transmission to the data transmission source when the data  
8 communication link is closed.

1 11. The communication apparatus according to claim 10,  
2 wherein the data transmission control unit is further operable to  
3 re-start data transmission to the data transmission source when  
4 the data communication link is re-opened.

1 12. The communication apparatus according to claim 4,  
2 further comprising:  
3 a transmitter operable to transmit transmission object data  
4 received from a data transmission source over a data link layer  
5 of the data communication link; and  
6 a data transmission control unit operable to suspend data  
7 transmission to the data transmission source when the data  
8 communication link is closed.

1 13. The communication apparatus according to claim 12,  
2 wherein the data transmission control unit is further operable to  
3 re-start data transmission to the data transmission source when  
4 the data communication link is re-opened.

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1 14. A data link monitoring control method for  
2 communication apparatus comprising the steps of:  
3 receiving unit link status flags, the link status flags  
4 included in frames received over a data communication link in  
5 response to link status flags included in frames transmitted over  
6 the data communication link; and  
7 determining whether a condition of the data  
8 communication link is normal based on whether the link status  
9 flags are received within a predetermined time.

1 15. The method according to claim 14, further comprising the  
2 step of:  
3 determining that the condition of the data communication  
4 link is invalid when the link status flags are not received within  
5 the predetermined time.

1 16. The method according to claim 15, further comprising the  
2 step of:  
3 closing the data communication link when the data  
4 communication link is determined to be invalid.

1 17. The method according to claim 16, further comprising the  
2 step of:  
3 opening the data communication link when the recovery  
4 of the data communication link is determined to be possible.

1 18. The method according to claim 17, further comprising the  
2 step of:  
3 negotiating validity or invalidity of the data  
4 communication link another device connected to the data  
5 communication link.

1 19. The method according to claim 18, further comprising the  
2 steps of:  
3 transmitting information requesting validity or invalidity  
4 of the data communication link to the other device connected to  
5 the data communication link; and  
6 receiving a response from the other device connected to  
7 the data communication link.

1 20. The method according to claim 19, further comprising the  
2 step of:  
3 setting the link status determination unit to a valid or  
4 invalid condition.

1 21. The method according to claim 20, further comprising the  
2 steps of:

3 transmitting information indicating a valid condition to  
4 the other device connected to the data communication link; and  
5 setting an invalid condition indicating invalidity of the  
6 other device connected to the data communication link.

1 22. The method according to claim 20, further comprising the  
2 step of:

3 transmitting an inspection frame to inspect a condition of the  
4 data communication link to the other device connected to the  
5 data communication link; and  
6 determining that a condition of the data communication  
7 link is normal upon receiving a response frame for the inspection  
8 frame from the other device connected to the data  
9 communication line within the predetermined time.

1 23. The method according to claim 17, further comprising the  
2 steps of:

3 transmitting transmission object data received from a data  
4 transmission source over the data communication link; and  
5 suspending data transmission to the data transmission  
6 source when the data communication link is closed.

1 24. The method according to claim 23, further comprising the  
2 step of:  
3 re-starting data transmission to the data transmission  
4 source when the data communication link is re-opened.

1 25. The method according to claim 17, further comprising the  
2 step of:  
3 transmitting transmission object data received from a data  
4 transmission source over a data link layer of the data  
5 communication link; and  
6 suspending data transmission to the data transmission  
7 source when the data communication link is closed.

1 26. The method according to claim 25, further comprising the  
2 step of:  
3 re-starting data transmission to the data transmission  
4 source when the data communication link is re-opened.